

REMARKS

Claims 12-18, 30 and 31 are now pending in the application. New claims 32-40 are presented herein for consideration. The Examiner is respectfully requested to reconsider and withdraw the rejection(s) in view of the amendments and remarks contained herein.

REJECTION UNDER 35 U.S.C. § 102

Applicants traverse the rejection of Claims 12-14, 16, 30 and 31 under 35 U.S.C. § 102(b) as being anticipated by Uchida et al. (U.S. Pat. No. 5,397,951).

With respect to independent Claim 12, Uchida et al. does not show, teach or suggest permanent magnets that define a substantially unmagnetized straight skewed areas.

Uchida et al. employs permanent magnets that do not form a substantially unmagnetized area. The permanent magnets in Uchida et al. are magnetized before assembly. Therefore, the permanent magnets are magnetized at all areas (including the edge portions) with a substantially uniform flux density. In contrast, there are portions of the permanent magnets in the present invention that are substantially unmagnetized. At the interfaces between the permanent magnets in Uchida et al., the combined flux density of adjacent permanent magnets may offset and be approximately zero. In other words, the positive flux of one permanent magnet is offset by the negative flux of an adjacent permanent magnet.

The permanent magnets according to the present invention are not magnetized near the interface. In other words, the flux density of adjacent permanent

magnets is approximately zero for a different reason. The interface between the permanent magnets according to the present invention has approximately zero flux density because the permanent magnets are substantially unmagnetized near the interface.

The stair step pattern in Uchida et al. is also not skewed as required by Claim 12. Skewing refers to an angular difference from the axial direction. The permanent magnets of the three axial sections in FIG. 6A of Uchida et al. have centroids that are axially aligned. On average, the stair step interfaces of Uchida et al. are aligned with the axial direction and are therefore not skewed. FIG. 11 of the present invention shows the skewed (with respect to the axial direction) unmagnetized area.

The stair step pattern in Uchida et al. is also not substantially straight as claimed. The only part of the assembly in Uchida et al. that is not magnetized is the support structure between the permanent magnets. This support structure is not a permanent magnet and is not straight – the support structure is stair stepped.

With respect to Claim 15 (which is dependent on Claim 12), Uchida et al. does not show, teach or suggest a first offset angle of the axial rotor sections is approximately equal to 360 mechanical degrees divided by a least common multiple of a first number of a stator slots of the machine and a second number of rotor poles of the rotor, and divided by a third number of the axial rotor segments. Therefore, Claim 15 is not anticipated by Uchida et al.

With respect to new Claim 32 (which is dependent on Claim 12), Uchida et al. does not show, teach or suggest using permanent magnets that are assembled before magnetization. The permanent magnets in Uchida et al. are magnetized prior to

assembly, which makes the assembly process more difficult. Therefore, new Claim 32 is not anticipated by Uchida et al.

With respect to new Claim 33 (which is dependent on Claim 12), Uchida et al. does not show, teach or suggest a magnetic field that is impressed in the permanent magnets which increases from a minimum value adjacent to one stair step interface to a maximum value approximately halfway between the one stair step interface and an adjacent stair step interface. Therefore, new Claim 33 is not anticipated by Uchida et al.

With respect to new Claim 34 (which is dependent on Claim 12), Uchida et al. does not show, teach or suggest using permanent magnets that have a generally rectangular cross section. The permanent magnets in Uchida et al. are parallelograms, which are more costly to manufacture. Therefore, new Claim 34 is not anticipated by Uchida et al. for this reason.

The more complex shape of the permanent magnets in Uchida et al. increases material and manufacturing costs due to the complex and non-uniform shape of the permanent magnets. The pre-magnetized permanent magnets are also difficult to assemble. By eliminating the need to handle magnetized parts during assembly, the assembly process is improved.

With respect to independent Claim 30, Uchida et al. does not show, teach or suggest initially attaching the permanent magnets in an unmagnetized state. Uchida et al. discloses permanent magnets that are magnetized before assembly, which makes the assembly process more difficult.

With respect to new Claim 35 (which is dependent on Claim 30), Uchida et al. does not show, teach or suggest using permanent magnets that have a generally

rectangular cross section. As described above, the permanent magnets in Uchida et al. are parallelograms, which are more costly to manufacture. Therefore, new Claim 35 is not anticipated by Uchida et al. for this reason.

For the foregoing reasons, Claims 12, 15, and 30 and new Claims 32-35 are allowable over Uchida et al. Claims 13, 14, 16-18, and 31 depend directly or indirectly from allowable Claims 12, 15, and 30 and are therefore allowable for the same reasons.

Applicants believe also that the new Claims 36-40 are also patentably distinguishable over the prior art of record.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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ATTACHMENT FOR CLAIM AMENDMENTS

The following is a marked up version of each amended claim in which underlines indicates insertions and brackets indicate deletions.

12. (Amended) A permanent magnet electric machine with reduced cogging torque, comprising:

a rotor; and

a plurality of axial rotor sections defined on a radially outer surface of said rotor,

wherein each of said axial rotor sections include a set of permanent magnets,

wherein axial rotor sections are rotationally offset and said edges of said permanent magnets define stair step interfaces, and

wherein said permanent magnets of said rotor include substantially [unmagnetized] unmagnetized straight skewed areas.

16. (Amended) The permanent magnet electric machine of claim 12 wherein each of said sets of permanent magnets include m magnet poles and [said] a magnetizing fixture that is used to magnetize said permanent magnets after assembly includes at least m conductor slots.